Wetland Rapid Condition Assessment: Development, Testing and Analysis

Honors Thesis for Environmental Studies

Erin Fehringer

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ABSTRACT

This thesis traces the process of development, testing and analysis of the Wetland Rapid Condition Assessment method for the Montana Department of Environmental Quality. This method is designed to assess wetland ecological condition in terms of a human disturbance gradient. I developed the form and tested its precision, comparability and accuracy by assessing 52 wetland sites in the Red Rocks region of southwestern Montana. In the fall of 2004, I analyzed the data and used that data to draw conclusions about the form's use and effectiveness. I found the precision between two trained interns to be high, but the precision between eight untrained volunteers was much less, due to the difference in amount of training. The Wetland Rapid Condition Assessment form proved to be comparable to two professional assessment forms: the USDA Natural Resource Conservation Service (NRCS) Riparian Assessment form and the BLM Proper Functioning Condition assessment method. These methods are comparable because they have a similar purpose, the assessment of condition. The Wetland Rapid Condition Assessment form was not comparable to the Montana Department of Transportation Wetland Assessment form, because the MDT form is targeted more towards functions and values than condition. The DEQ data correlated well with intensive vegetation data, which also helped determine the form's limitations, such as delineating condition categories. My results suggest that with careful revision and comprehensive training of interns and volunteers, the Wetland Rapid Condition Assessment form will prove to be useful in determining wetland condition in the future.

INTRODUCTION

Wetlands are unique, valuable components of watersheds that provide essential functions for the environment and our society. A wetland can be as small as several square meters and as large as thousands of acres. They may contain a measurable amount of water or they may not. Some wetlands (fens and depressional wetlands, for example) are defined by their hydrology, geomorphology, the type of vegetation that grows in them or the amount of organic matter built up in the soil, and may contain water for a short duration. Consequently, the term "wetland" does not always refer to a body of water.

Wetlands provide important habitat for countless species of wildlife: birds, amphibians, reptiles, fish, mammals, and macroinvertebrates. They also host some of the most diverse collections of vegetation on the landscape. In addition, wetlands provide functions such as flood control, the transfer and storage of water, the decomposition of organic matter, biochemical transformation and storage, filtering and cleansing of water, erosion control, timber production, recreation, and food production (Danielson 2002).

Eighty percent of America's bird population and over fifty percent of protected migratory bird species rely on wetlands (Danielson 2002). Most of the United States' amphibians (frogs, toads, and salamanders) need wetlands at some point in their life cycle for reproduction or survival (Danielson 2002). More than 95 percent of commercially harvested fish and shellfish in the United States are directly or indirectly dependent on wetlands (Danielson 2002). Wetlands only account for 3.5 percent of the United States' land area (this number was much higher in the past), but about 50 percent of federally listed endangered animals depend on wetlands for survival (Danielson 2002).

Between 1986 and 1997, a net of 644,000 acres of wetlands was lost (Dahl 1997). The estimated wetland loss rate is 58,500 acres annually (Dahl 1997). 30% of this loss has been attributed to urban development, 26% to agriculture, 23% to forestry and 21% to rural development (Dahl 1997).

It is clear that wetlands are not something to be taken for granted. However, we have only recently started to understand the importance of wetlands. Historically, wetlands were seen as valuable land for agriculture or development and as something that merely got in the way. Wetlands have been plowed over, filled in with soil, built on, cut in half by roads or railroads, and dewatered. Today, both federal and state agencies mandate the protection, mitigation of impacts and monitoring of our remaining wetlands.

The Montana Department of Environmental Quality already funded the development of several wetland monitoring and assessment efforts. However, these projects are expensive and complicated, so only highly-trained personnel are able to monitor the wetlands. Each person has a specific area of knowledge, so the monitoring is divided into several areas of study such as vegetation, amphibians, birds and water quality.

Over the past two years, it has been my task as an intern at DEQ to develop a quick and simple, yet comprehensive assessment method for wetlands. This method is called Wetland Rapid Condition Assessment. The method is designed to require an average of one hour in the field per site, and is basic enough for college interns and volunteers to understand. The Wetland Rapid Condition Assessment is easy and economical for DEQ and may be used by other agencies and non-profit organizations in the future.

This thesis follows my process through development of the Wetland Rapid Condition Assessment method, testing of the method in the field, and analysis of data.

BACKGROUND

The Department of Environmental Quality's wetland monitoring program consists of three levels of monitoring (see Figure 1). Level 1 is landscape monitoring (e.g., aerial photo assessments), Level 2 is Rapid Condition Assessment and Level 3 is intensive monitoring. Level 1 monitoring helps to identify and select sites and is used to describe surrounding land use, Level 2 monitoring gives a general idea of wetland condition and probable stressors, and Level 3 monitoring provides detailed sampling and analysis of wetland components such as vegetation, birds, and hydrology. Specialists that are contracted by the DEQ conduct Level 3 monitoring. All three levels of monitoring tie together to produce a well-rounded assessment.

Level 3 monitoring has been conducted for several years, so the introduction of a Rapid Condition Assessment will compliment prior assessment efforts. The first couple of field seasons the Rapid Condition Assessment will be calibrated by conducting the Level 2 assessment method at sites that have already been studied by Level 3 specialists. After we are confident that the Rapid Condition Assessments provide a good indication of wetland condition, new sites will be assessed solely by using the Wetland Rapid Condition Assessment protocols. However, when deemed necessary Level 3 assessments will be used to verify the impacts that are flagged by the Level 2 assessments.

FIGURE 1: THREE LEVELS OF MONITORING

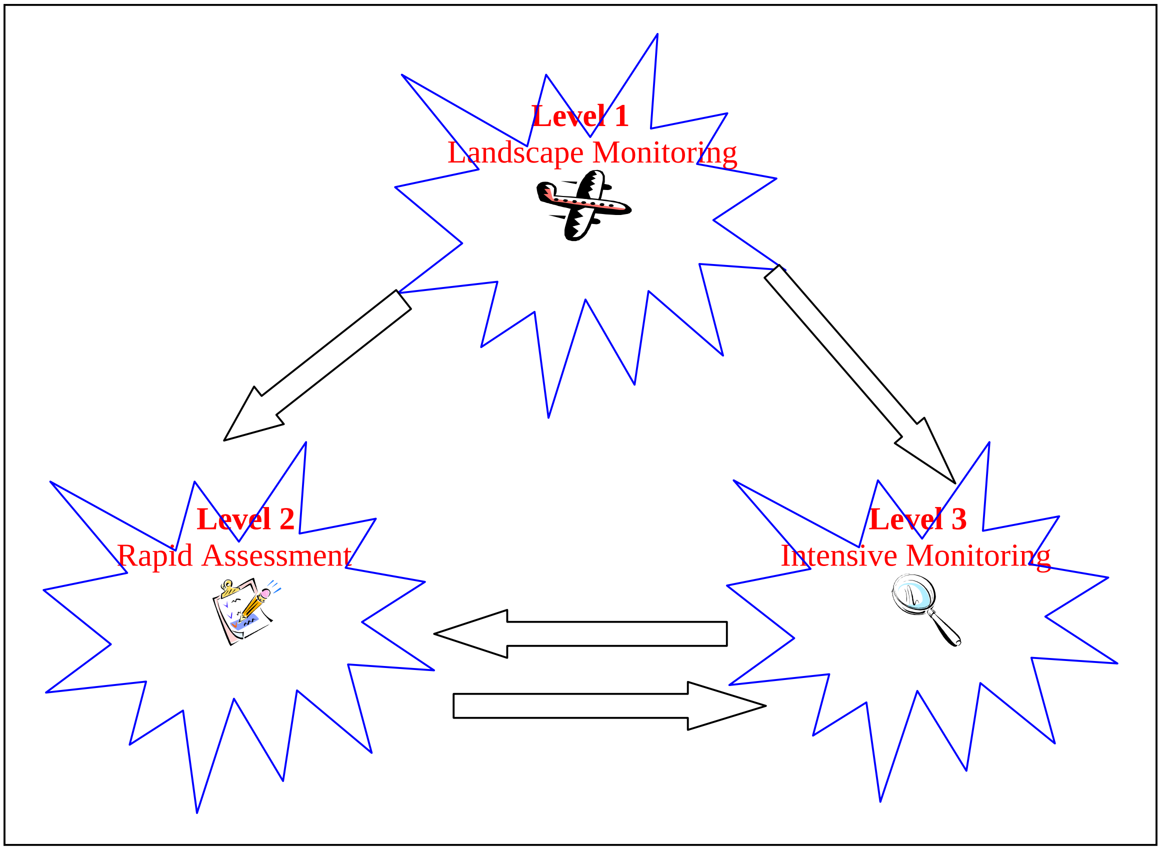

Figure 1: Three Levels of Monitoring. The DEQ wetland program consists of three levels of monitoring. Level 1, Landscape Monitoring, helps to select, identify and characterize sites using aerial photos. Level 2, Rapid Condition Assessment, is a “red flag” tool that gives a basic idea of wetland condition and determines which sites need further attention. Level 3, Intensive Monitoring, is a more detailed, quantitative assessment conducted by professionals. Level 3 will only be conducted at sites that have been flagged by Level 2. This flow chart shows how the levels affect each other.

STAGE 1: DEVELOPMENT

RESEARCH

Wetland Rapid Condition Assessment is not a new concept to other state government wetland programs, but it is new to Montana. Several states have existing Rapid Condition Assessment forms. I read and reviewed these methods in order to assess which aspects to include in a form. For Montana, the most applicable methods (in terms of DEQ's objectives) were California, Washington, Ohio and Delaware (see Appendix A for research notes). I used portions from each of these methods to determine what "indicators" we should assess with the Wetland Rapid Condition Assessment form.

USING INDICATORS AND STRESSORS TO DETERMINE WETLAND CONDITION

Indicators are elements of a wetland community that reveal the ecological health of the wetland. Indicators are affected by stressors, which are external sources of disturbance acting on the wetland. The indicators that are used for assessing wetland conditions are those that can usually be linked to human-caused stressors.

The goal is to come up with the most comprehensive list of indicators possible, to be able to adequately assess the true condition of each wetland site we survey. It must be kept in mind, however, that the more detailed, time-consuming and higher knowledge-based metrics will be reserved for the Level 3 specialists. While we want to make this wetland assessment very well-rounded, the field methods must still remain truly "rapid."

What kind of indicators can determine wetland condition in only a few hours of field analysis? Plants are a perfect example: "Plants offer several advantages as indicators of wetland integrity. They effectively respond to environmental changes and have been used in univariate toxicity tests because they are acutely sensitive to unbound heavy metal contaminates such as copper. Plants offer a rich assemblage to provide clear and robust signals of human disturbance. Rooted plants typically must survive in the same location their entire life, often for several years, making them a good indicator of conditions at that place" (Batzer, et al. 2001).

While plants can easily reveal environmental disturbance, amphibians are great tools in linking wetlands to surrounding landscapes because of their varying breeding and wintering habits (many species breed or winter as far as several miles away from their home) (Maxell 2003). "Amphibians are important ecological components both in wetlands and on land. They are unique among vertebrates in many ways but for biological assessments, are especially promising in their great potential capability for linking wetlands with surrounding landscapes" (Calhoun, et al. 2001). Calhoun continues:

> Declines [in amphibian populations] raise the global eyebrow because amphibians are indicators of ecosystem health. A thin, moist, highly permeable skin, jellied, unshelled eggs, possession of aquatic and terrestrial life histories, restricted home range and limited dispersal abilities of many species make amphibians effective biomonitors. Dramatic changes in their populations and increased incidences of diseases and malformations, particularly in seemingly pristine areas, highlight concerns about general environmental deterioration.

After examination of possible indicators, I developed a preliminary outline of indicators and stressors we want to include in the form. The indicators that we want to assess include: land use, hydrogeomorphology, vegetation, habitat, soils, water quality and recovery. Each of these indicators could become categories in a standardized form (see Appendix B for complete outline).

INTER-AGENCY MEETINGS FOR INPUT

We held several meetings with various agencies, organizations and collaborators to gather useful input on the content and organization of the Rapid Condition Assessment outline. In July 2003, I met with a core group of collaborators, who came to be called the "Technical Work Group" to discuss the outline. Among those present were: Marc Jones, ecologist and vegetation specialist of Montana Natural Heritage Program, Anna Noson, bird specialist of the University of Montana, Lynda Saul, wetlands coordinator of DEQ, Randy Apfelbeck, my direct wetlands supervisor of DEQ, Brad Cook, biologist of the University of Montana, Bryce Maxell, amphibian specialist of the University of Montana, and Rob Hazlewood, wildlife biologist of Montana Fish, Wildlife and Parks.

After meeting with the above collaborators, I revised the Rapid Condition Assessment outline. The Technical Work Group decided to eliminate the soils section because soil assessments require more detailed scientific knowledge, training and equipment than is practical for a Rapid Condition Assessment project. We condensed the habitat and land use sections into smaller, less detailed sections, deciding to focus primarily on four sections: water quality, hydrogeomorphology, buffer land use and vegetation.

In September 2003, DEQ held a wetlands conference at the University of Montana, which included staff from nearly every agency, organization, or tribal nation that had concerns pertaining to wetlands conservation. I developed a Powerpoint presentation about our plans for Rapid Condition Assessment, which Randy Apfelbeck presented to the group. An in-depth discussion ensued in which everyone had the chance to voice their particular concerns regarding the Rapid Condition Assessment method.

One suggestion that arose in the meeting was the assessment of beaver activity at wetland sites. Bryce Maxell explained that beaver activity actually hydrologically alters the wetland site, creating a new type of system where water still flows through the stream, but there are many pools as a result of damming. Everyone agreed that incorporating beaver activity into the site's score would be difficult, so it was suggested that we simply include a question where the assessor notes whether or not there is beaver activity and elaborates on the specific type of activity. We eventually decided to treat beaver ponds as a separate type of wetland, and would later use some of Bryce's beaver pond sites to test the Rapid Condition Assessment form.

ROUGH DRAFT

Drawing from the revised outline and the suggestions from the various meetings, Elizabeth Crowe from the Montana Natural Heritage Program put together a rough draft of a Rapid Condition Assessment form (see Appendix C). The form consisted of four conditional assessments including: water quality, hydrogeomorphology, buffer and vegetation. Each section consisted of questions that were given numerical scores; these scores were combined at the end and calculated into a final score. The form also contained several questions intended for observation purposes that did not factor into the score.

Elizabeth sent the form to myself, Randy Apfelbeck, and several other collaborators for revision. While we were determining our own individual suggestions for the form's revision, Elizabeth accepted a new position at a different agency, and I was given the task of finishing the form.

REVISIONS AND FINAL DRAFT

Most of the changes I made to the form were formatting changes to make the form easier to read and understand. Being the youngest, most inexperienced member of those developing the form, it became my task to decide what interns and volunteers could easily understand. Thus, the wording in many questions needed changing.

When a draft of the form was sent to contributors, I received many suggestions for improvements. Rich Sumner (USEPA) suggested the addition of a section or question about wetland restorability. He thought it was important to get an idea of how easily the wetland could be restored to natural condition. One component of this section is how the wetland is trending, for example, whether it's trending downward, upward or remaining stable. This is important in helping determine how easily a wetland can be restored. If it is already trending upward, then restoration will not be as difficult; if it is trending downward, restoration could be expensive and time-consuming.

Bryce Maxell suggested the inclusion of a site map, which he uses in his amphibian surveys. A site map would document how the wetland site looks in terms of size and shape. The dominant vegetation communities would also be documented, in the assessment area as well as the buffer area. Bryce mentioned that the most useful aspect of a site map is the documentation of where photos were taken and from what direction. This helps later surveyors to get an idea of what the site looked like from all angles.

Randy decided that the "wetland type" question on the front page should include a numbered list of possible wetland classification types. I roughly followed the HGM classification system, but I simplified the terminology to make the classification easier for volunteers or interns with limited experience. I consolidated all the observation/classification questions into one section called “Site Characterization” that does not factor into the overall score. Bryce provided us with a list of amphibian and reptile species, along with their corresponding four-letter identification codes (determined from the first two letters of the genus and species) to be used in identifying herpetofauna species at the wetland sites.

The Technical Work Group decided that the vegetation section did not include enough material pertaining to browse utilization, shrub architecture, shrub health and shrub density. These are important tools in determining wetland condition, because the health and density of shrubs is directly proportional to wetland condition (the healthier and denser the shrubs, the better the health of the wetland). I wrote several questions pertaining to these important topics and incorporated them into the form.

The most difficult part of revising the Rapid Condition Assessment form was working out the scoring mechanism. Since Elizabeth had not left me with any directions as to how she came up with the scoring method, I had to decipher it independently, with help from Randy. Adding questions presented a dilemma as well, because I had to then readjust the scoring to account for the new questions. After making all these changes, I had a final draft of the form (see Appendix D) and was then ready to test the form in the field.

INTER-AGENCY COOPERATION

In the process of presenting the Rapid Condition Assessment form to other agencies for suggestions, we found out that the Montana Department of Transportation

(MDT) had created a wetland assessment form in the past that was similar to our Rapid Condition Assessment. Larry Urban, a biologist for MDT, voiced his concern to me that DEQ was needlessly creating a form that MDT had already produced. I agreed to review the MDT Wetland Assessment Method to look for possible overlap (see Appendix E).

After reviewing the MDT form, I concluded that it was actually quite different from the DEQ Rapid Condition Assessment form, with only minor similarities. The MDT form assesses wetland functions and values (for mitigation purposes) as well as wetland condition, while the DEQ form focuses only on wetland condition (in more depth). DEQ is interested in assessing how human disturbance is affecting the ecological condition of a wetland, and expressing this in a numerical score that relates condition.

A study conducted by Rutgers University and the New Jersey Department of Environmental Protection in 2004 compares functional and biological assessments:

> Functional and biological assessments convey different types of information about a wetland; they also fit differently into the regulatory framework. Function generally focuses on the services that a wetland provides to the environment, such as floodwater storage, sediment retention, water quality improvement, etc. Biological assessments are more directly linked to water quality are used to determine the condition of the wetland plant and animal communities. However, a wetland that has high functional value may be low quality from an IBI [Indices of Biological Integrity] perspective. For example, wetlands in an urban setting may provide high functional value to the surrounding landscape but be quite degraded from a quality perspective (Hatfield et al. 2004).

This passage from the New Jersey study accurately describes the difference between the MDT and DEQ methods, and the reasons why they fulfill different regulatory purposes.

MDT is interested in assessing how a wetland is functioning (e.g. water storage or flood attenuation) and how valuable each wetland is in terms of endangered species and fish habitat, and recreation and education potential. These objectives are completely different from DEQ's objectives. Larry was still convinced that we could combine efforts or maybe combine our forms, so Randy and I agreed to test the MDT form in the field along with the DEQ form.

The Natural Resource Conservation Service (NRCS) also has a form that could be either combined or used in concert with the Rapid Condition Assessment form (see Appendix F). Their form is called the Riparian Assessment, and it appeared to be more similar to the Rapid Condition Assessment form than MDT's form. The NRCS form assessed wetland condition in three sections: geomorphic considerations, vegetative considerations and functional considerations. The form is already used by DEQ water quality monitors to assess the condition of larger streams and rivers. Randy and I agreed to test the NRCS form in the field as well, but since the form focuses on streambank stability it could only be used at the riverine sites.

STAGE 2: TESTING

FIELD PREPARATION

The first step in preparing for the field season was to select site locations. Randy and I decided that we would assess two types of wetland sites: riverine wetlands and beaver ponds. Marc Jones and Anna Noson used riverine site locations from a BLM study conducted in the past, and beaver pond site locations from Bryce Maxell's amphibian surveys. We wanted to assess sites that covered a wide range of condition, so Marc and Anna used the BLM and amphibian survey results to estimate condition and then select a wide range of sites. The final list of sites consisted of 36 riverine sites and 34 beaver sites (see Table 1).

After the site locations were selected, I mapped the points in ArcView GIS (see Appendix G) and on Forest Service maps. I also entered the coordinates into a GPS unit and collected aerial photos from BLM (see Appendix H). All these resources were helpful in finding the sites in the field.

In May, a second intern, Erin Farris, was hired to assist me on the wetlands project. With a second intern, I wouldn't have to be alone in the field, which could be unsafe, and then the wetlands project can be continued after I graduate. Before heading out into the field to test the form, we trained Erin in field procedures and how to use the Rapid Condition Assessment form. We gathered up all the necessary equipment and created a checklist to make sure we remembered everything (see Appendix I).

At the end of May we spent two days with the NRCS staff, who provided training on the use of their form, and one day training with MDT staff. We also spent a day in the field with our Level 3 Collaborators to discuss and evaluate the form.

TABLE 1: 2004 RAPID ASSESSMENT SITE LOCATIONS

Site Name	Wetland Type	Latitude	Longitude
Cabin	Riverine	44.63824623	-113.0099766
SF Watson Upper	Riverine	45.0959237	-113.1963112
Shenon	Riverine	44.92784063	-113.2286212
Rape	Riverine	44.97006355	-113.2128626
Pass	Riverine	44.73984516	-113.0713416
Muddy Trib	Riverine	44.72151013	-112.8928622
Little Sheep	Riverine	44.58333905	-112.6729578
Little Sage Trib	Riverine	44.81923499	-112.438122
Grimes	Riverine	45.04960394	-113.322681
Cow	Riverine	44.65020042	-112.955231
Camp	Riverine	45.6815662	-112.5609901
WF Blacktail	Riverine	44.78252957	-112.310758
SF Watson Lower	Riverine	45.07747151	-113.1964928
Taylor	Riverine	45.22943586	-112.9953916
Morrison	Riverine	44.70083325	-113.053969
McNinch	Riverine	44.69827956	-112.8738769
Little Sage	Riverine	44.79545645	-112.5267898
Little Beaver	Riverine	44.52808269	-112.4775276
Frying Pan	Riverine	44.94854129	-113.4290904
NF Craver	Riverine	44.66487971	-113.0180378
Big Hollow	Riverine	45.01306736	-113.3580338
Surveyor	Riverine	45.13683556	-113.4177163
MF Price	Riverine	44.56140132	-112.1240049
Tendoy	Riverine	44.45170684	-112.9215991
Nicholia	Riverine	44.45793451	-112.9118798
NF Everson	Riverine	44.90777381	-113.3316752
Dyce	Riverine	45.27779575	-113.0336637
Bloody Dick	Riverine	45.06979467	-113.4239166
Black Canyon	Riverine	44.86336456	-113.3287752
WF Madison	Riverine	44.74437753	-111.7347502
Indian	Riverine	44.60515313	-113.0057793
EF Blacktail	Riverine	44.84571889	-112.2039635
Deadman	Riverine	44.51797991	-112.8064994
Lower Nicholia	Riverine	44.54776603	-112.8269301
Bear	Riverine	44.92722491	-113.4107474
Birch	Riverine	45.37975699	-112.7960783
Clark Canyon	Beaver Pond	44.98888	-112.71364
Nip and Tuck	Beaver Pond	44.8395	-113.32555
Pine	Beaver Pond	44.49645	-112.78461
Shenon	Beaver Pond	44.92074	-113.19542
Nicholia	Beaver Pond	44.41395	-112.86721

Nicholia	Beaver Pond	44.42404	112.89002
Tendoy	Beaver Pond	44.44762	-112.92393
Rock Canyon	Beaver Pond	44.80040986	-112.9101748
Maiden Ck NF	Beaver Pond	44.86757	-113.20454
Maiden Ck NF	Beaver Pond	44.86549	-113.18961
Maiden Ck	Beaver Pond	44.86921	-113.22853
Jeff Davis Ck	Beaver Pond	44.88717	-113.17753
Jeff Davis Ck	Beaver Pond	44.88613	-113.18216
Maiden Ck NF	Beaver Pond	44.86412	-113.18684
Kate Ck	Beaver Pond	44.77045	-112.9682
Kate Ck	Beaver Pond	44.77633	-112.97435
Kate Ck	Beaver Pond	44.78287	-112.97821
Big Beaver	Beaver Pond	44.54757	112.38271
Beav-3	Beaver Pond	44.54797	112.38271
Craver NF	Beaver Pond	44.66553	113.01652
Craver NF	Beaver Pond	44.6638	113.01952
Horse Prairie	Beaver Pond	44.81824	113.21519
Horse Prairie	Beaver Pond	44.81939	113.21835
Maiden Ck MD	Beaver Pond	44.85555	-113.21243
Maiden Ck NF	Beaver Pond	44.86751	-113.20834
Middle	Beaver Pond	44.49377	112.43363
Middle	Beaver Pond	44.49113	112.43349
Middle	Beaver Pond	44.49625	112.43261
Price	Beaver Pond	44.56384	112.12379
Poison	Beaver Pond	44.48922	112.41627
Poison	Beaver Pond	44.48713	112.41747
Poison	Beaver Pond	44.4845	112.4185
Poison	Beaver Pond	44.47806	112.41344
Sawmill	Beaver Pond	44.53474	112.4845

FIELD PROCEDURES

We tried to follow a field schedule while on our field trips, but the schedule had to be constantly changed when we couldn't find a site or couldn't get access to a private land site. Many of our beaver sites were on the same stream, sometimes five sites on one stream within the space of a mile or two. After visiting several of these, we decided it was not necessary to visit sites that close together, so we eliminated some of the beaver sites. We also eliminated several of the sites that we had difficulties accessing due to roads or ownership. By the end of the summer, we had visited 31 riverine sites and 21 beaver sites.

Each field trip was about 4 or 5 days long, and as the summer progressed, we became more efficient. We started with visiting only 2 or 3 sites a day and by the end of the summer were able to visit 4 or 5 sites a day. We decided we would rather work long days than long weeks.

Our site locations were so remote that we usually didn't get to camp in a campground. We didn't even bother putting up a tent, we just slept in the canopy of our truck, which made us even more efficient in setting up and breaking camp. Fieldwork is draining, but I enjoyed the adventure and the scenery. Each day presented a new adventure and different problems we had to solve.

We used a combination of the GPS unit and Forest Service maps to find the sites, but the maps don't show every road, and in some cases the roads on the maps don't exist anymore. The GPS was only helpful in locating the exact spot on the stream once we got within a few miles. In one case, we had to hike 6 miles through the sagebrush (without a trail) to get to several sites because the road we needed to take had been closed.

At each site, we started by filling out the DEQ form, taking photos and measuring the water quality with the Horiba meter (a Horiba is a water quality multi-meter that measures pH, conductivity, dissolved oxygen, temperature, salinity and turbidity). Then we filled out the NRCS form (only at riverine sites) and the MDT form. We recorded observations, difficulties, photo descriptions and time spent on each method in a fieldbook. We averaged 62 minutes of total time spent at each site.

When we returned from the field, we spent the weeks in between trips in the office entering data. We entered all the data into Excel spreadsheets, scanned the site maps into Adobe PDF files and downloaded the photos from the digital camera. Then we prepared again for the next field trip.

VOLUNTEER TESTING

We added one more element to our testing, which involved Bryce Maxell and his Amphibian Survey crew of 7 college students. We met Bryce and his crew out in the field, along with Randy, and quickly explained the Rapid Condition Assessment method. Erin and I had to continue surveying our sites, so we left Bryce, his crew and Randy with a stack of forms and their limited understanding of the form. They went to 11 depressional wetland sites and filled out the Rapid Condition Assessment forms along with their amphibian survey. Each member filled out the form individually without discussion.

The purpose of this exercise was to test how well volunteers would understand the form with minimal training. We also wanted to test the applicability of the form to depressional wetlands. Bryce provided us with his data and a list of comments describing their difficulties with the form and suggestions for changes (see Appendix J for comments). Data is presented and discussed in Stage 3.

DIFFICULTIES ENCOUNTERED

While testing the DEQ, MDT and NRCS forms in the field, Erin and I recorded every difficulty we encountered with each form. Difficulties included: problems knowing how to assess a site in particular categories or questions, difficulties locating a site, observations pertaining to the usefulness and/or pertinence of particular questions in the context of the sites we visited, or suggestions for making the forms easier to understand and fill out (see Appendix K for a complete list of comments).

STAGE 3: ANALYSIS

DATA ANALYSIS: PRECISION, COMPARABILITY & ACCURACY

Once all the data had been collected in the field and entered in the database, the next step was data analysis. Data analysis is necessary for giving meaning to the data and formulating conclusions. We looked at three things when analyzing the data: precision within the DEQ form, comparability between different forms and accuracy relative to professional assessments.

To assess precision, I compared the results from Erin Farris' assessments and my assessments and calculated the difference in overall scores and scores on individual questions. To assess comparability, I compared the results of the different forms to each other and calculated the relative percent difference for each site. I also compared the DEQ and NRCS results to a BLM study conducted previously. To assess accuracy, I compared Erin's and my data to that collected by the intensive vegetation contractor Marc Jones.

In May 2004, I wrote the Wetlands Rapid Condition Assessment Sampling and Analysis Plan to be submitted to the Environmental Protection Agency as a means of illustrating our plans, objectives and timetable for the Rapid Condition Assessment project. In the Analytical Methods section, I outlined DEQ's goals for data analysis:

> All three methods will be evaluated for how much time they took in the field, how easy they were to perform and understand, how accurate and comparable the results are, and what difficulties were encountered. Using this information, DEQ can determine how they want to refine and implement Rapid Condition Assessments in the future. It is possible, if results are similar, to combine the DEQ and MDT methods somehow (e.g., we may develop separate modules for condition and function assessments or for different levels of complexity). If this is not possible, some questions may be able to be used from the MDT method and vice versa. MDT and the DEQ TMDL program hope to benefit from this study by gaining suggestions for refinement. The interns' results will also be sent to an MDT contractor for further analysis. If the NRCS Stream Reach Assessment was reasonably useful at the small riverine sites visited in the Red Rocks HUC, it can be incorporated into the Rapid Condition Assessment form. It contains some fairly complicated hydrology elements that may or may not be applicable to such small systems (Fehringer 2004).

This passage from the Sampling and Analysis Plan not only summarizes data analysis goals, but it also suggests possible future uses for the form.

RESULTS

PRECISION

When I analyzed data precision between Erin Farris's and my data, I calculated the relative percent difference between her DEQ scores and mine. DEQ set a precision goal of less than or equal to 20% relative percent difference. The average relative percent difference between mine and Erin's scores on the DEQ form, for all the sites, was 7% (see Figure 2).

I also analyzed data precision between mine and Erin's scores on each individual question, which helps us to determine which questions are inconsistent and difficult to understand. Knowing this will be essential in revising the form. I calculated the coefficient of variability for each question by first calculating the mean score, then dividing by the range of possible scores (see Figure 3).

The five questions with the highest coefficient of variability, starting with the highest, are: "blockage," "browse utilization," "removal of tree layer," "roads," and "shrub health." I will discuss these in detail in the Conclusions section.

FIGURE 2: PRECISION BETWEEN INTERNS

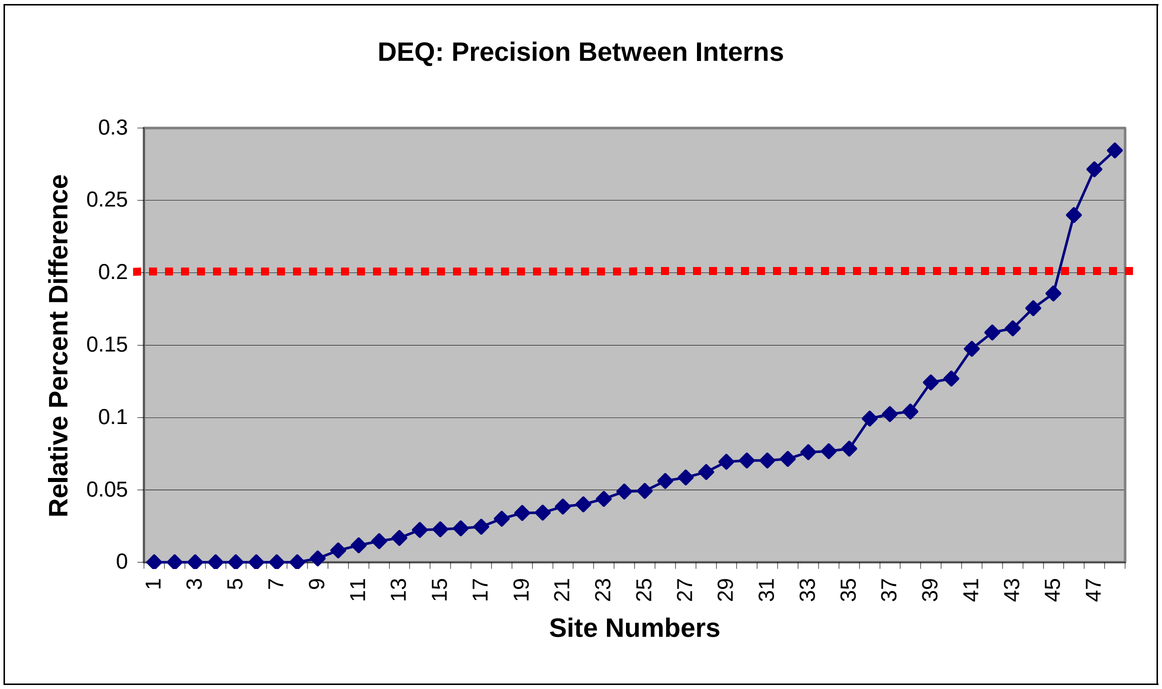

Figure 2: Precision Between Interns. The red dotted line represents the goal of less than or equal to 20% relative percent difference.

FIGURE 3: INDIVIDUAL QUESTION PRECISION

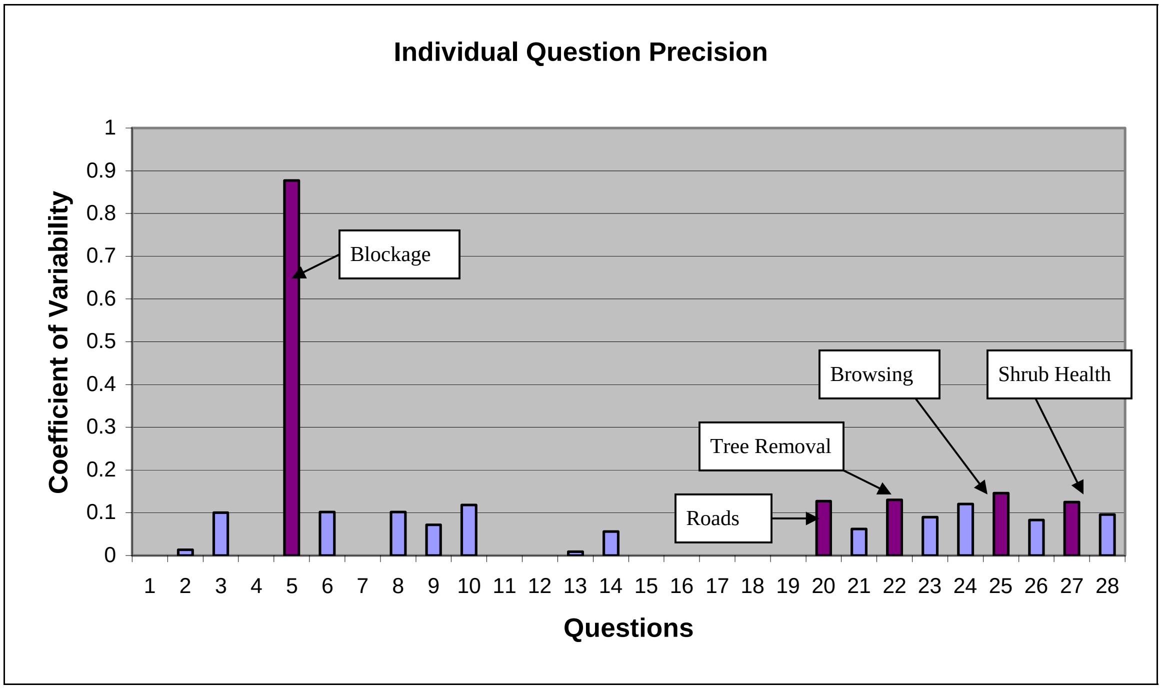

Figure 3: Individual Question Precision. The five questions with the highest coefficient of variability are highlighted in purple.

COMPARABILITY

Next, I analyzed the data comparability by comparing the results of the DEQ, MDT and NRCS forms. I calculated the relative percent difference between the forms at each site. Again, keep in mind our goal of less than or equal to 20% relative percent difference. In comparing the DEQ and MDT forms, 31% of the sites met our relative percent difference goal, with an average relative percent difference of 31% (see Table 2 and Figure 4). In comparing the DEQ and NRCS forms, 60% of the sites met our goal, with an average relative percent difference of 24% (see Table 3 and Figure 5).

TABLE 2: DEQ/MDT COMPARISON

Site Name	DEQ average scores	MDT average scores	Relative Percent Difference
Muddy Trib	0.48	0.48	0.00
Tendoy	0.50	0.50	0.01
Big Hollow	0.39	0.40	0.01
Little Beaver	0.51	0.48	0.06
Deadman	0.44	0.47	0.07
Morrison	0.51	0.45	0.12
Cow	0.38	0.43	0.13
Camp	0.64	0.53	0.18
Grimes	0.38	0.47	0.21
Beav-3	0.71	0.56	0.24
WF Madison	0.67	0.52	0.25
Jeff Davis 1	0.66	0.49	0.29
Bear	0.75	0.52	0.36
Maiden 5	0.75	0.52	0.36
Sawmill	0.63	0.47	0.36
NF Everson	0.82	0.55	0.39
Shenon	0.83	0.55	0.41
Kate 3	0.68	0.44	0.43
SF Watson Lower	0.67	0.43	0.43
EF Blacktail	0.56	0.36	0.44
Shenon B	0.85	0.53	0.46
Kate 1	0.85	0.53	0.46
Little Sage	0.72	0.45	0.46
Poison 1	0.91	0.54	0.51
Middle 3	0.91	0.53	0.53
Poison 3	0.81	0.45	0.57

FIGURE 4: DEQ/MDT COMPARISON

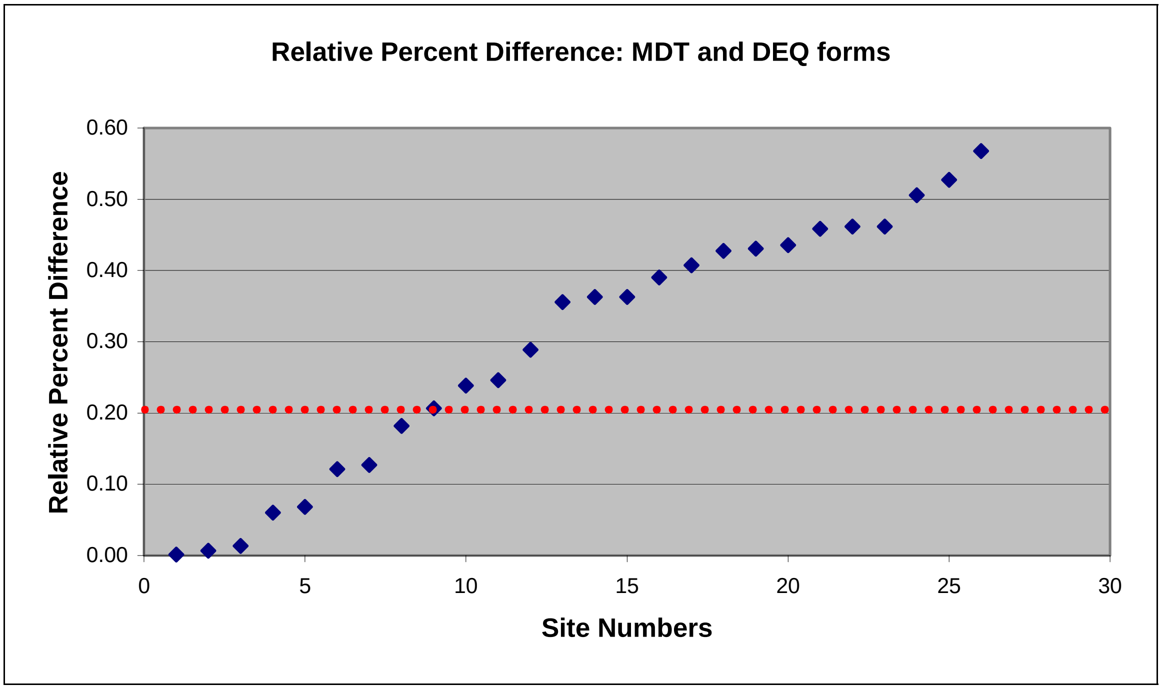

Figure 4: DEQ/MDT Comparison. The data points were put in ascending order according to relative percent difference, in order to see the range. The red dotted line represents DEQ's goal of less than or equal to 20% relative percent difference. As shown, 8 out of 26 sites, or 31% of sites met that goal.

TABLE 3: DEQ/NRCS COMPARISON

Site Name	NRCS Average Score	DEQ Average Score	Relative Percent Difference
East Fork Blacktail	0.86	0.85	0.02
Camp Creek	0.65	0.64	0.02
NF Everson Creek	0.81	0.83	0.03
Nicholia Creek	0.53	0.51	0.03
Shenon Creek	0.70	0.68	0.03
Deadman Creek	0.42	0.44	0.05
Little Sage Trib	0.68	0.65	0.06
Cow Creek	0.56	0.51	0.09
Surveyor Creek	0.64	0.58	0.10
SF Watson Creek Lower	0.50	0.56	0.11
Grimes Creek	0.82	0.71	0.14
Bear Creek	0.87	0.75	0.14
Tendoy	0.58	0.50	0.15
Muddy Trib	0.57	0.48	0.17
Big Hollow Creek	0.47	0.39	0.17
West Fork Blacktail	0.57	0.67	0.17
Black Canyon Creek	0.81	0.68	0.17
Indian Creek	0.73	0.61	0.18
WF Madison	0.53	0.66	0.21
Morrison Creek	0.38	0.48	0.22
Little Beaver Creek	0.66	0.51	0.25
Cabin Creek	0.56	0.39	0.34
Little Sheep Creek	0.53	0.75	0.35
Frying Pan Creek	0.63	0.44	0.36
Lower Nicholia Creek	0.53	0.81	0.41
SF Watson Creek Upper	0.68	0.45	0.41
Little Sage Creek	0.50	0.29	0.53
Pass Creek	0.38	0.66	0.54
McNinch Creek	0.75	0.37	0.69
Rape Creek	0.58	0.20	0.97

FIGURE 5: DEQ/NRCS COMPARISON

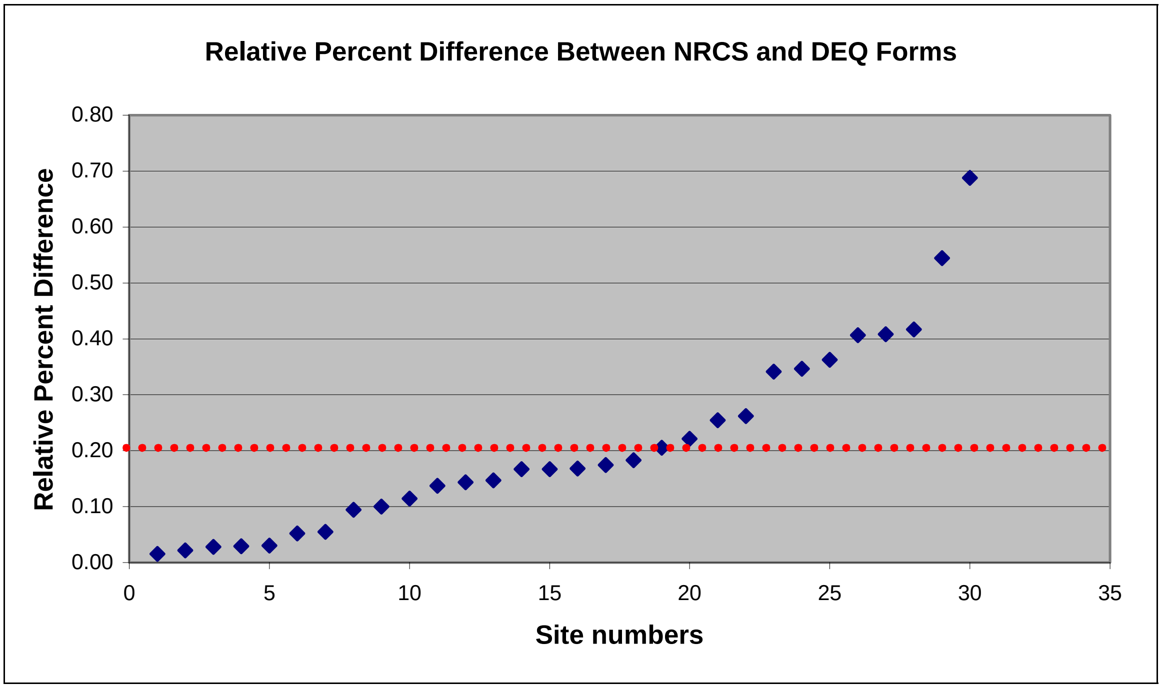

Figure 5: DEQ/NRCS Comparison. The data points were put in ascending order according to relative percent difference, in order to see the range. The red dotted line represents DEQ's goal of less than or equal to 20% relative percent difference. As shown, 18 out of 30 sites, or 60% of sites met that goal.

I also compared the DEQ form with a BLM and USFS study, which gave one of three scores to each site: PFC, proper functioning condition, FAR, functioning at risk, and NF, not functioning. The DEQ form has four categories associated with the scores: Poor (0.0-0.4), Fair (0.4-0.7), Good (0.7-0.9), Excellent (0.9-1.0). These categories are arbitrary and will probably be altered at a later date to fit the proper scale. For instance, the scores from this summer's assessments did not include any "excellents," so the range for "excellent" will have to be lowered.

When compared, the DEQ and BLM/USFS assessment scores were fairly similar (see Table 5). The scores were always within one category of each other, with the exception of one site (highlighted on the table). It is important to take into account the amount of time between the BLM/USFS and DEQ assessments. The exact date of the BLM/USFS assessments are not known, but many were likely to be at least 10 years prior to the DEQ assessment. The condition of the sites could have changed quite a bit in 10 years, which may explain the difference in assessment categories.

If BLM surveyors labeled a site as "not functioning," the grazing practices may have been changed and the site could've recovered by the time Erin and I visited the site. The opposite could also be true: if BLM surveyors labeled a site as "proper functioning condition," grazing could have intensified over a 10-year period, degrading the condition of the site. Taking into account the time difference, the DEQ Rapid Condition Assessment produced similar results to that of the BLM and USFS assessment.

When I analyzed the data collected by Bryce and his crew (to test how well volunteers would fill out the DEQ form without much training), the average standard deviation was 0.75, compared to the average standard deviation of Erin and I's data, 0.17.

I also calculated the standard deviation for each individual question, to determine which questions Bryce's crew had the most trouble with. I found that the five questions with the highest standard deviation, in order from highest to lowest, were: blockage, browse utilization, removal of tree layer, roads, and shrub health.

TABLE 4: DEQ AND BLM/USFS COMPARISON

BLM	DEQ
PFC	Good
NF	Fair
PFC	Good
PFC	Fair
NF	Fair
PFC	Fair
NF	Fair
NF	Fair
PFC	Fair
FAR	Fair
NF	Good
PFC	Good
FAR	Fair
NF	Fair
FAR	Poor
NF	Fair
PFC	Fair
FAR	Fair
NF	Fair
FAR	Fair
FAR	Fair
FAR	Poor
NF	Fair
FAR	Fair
PFC	Good
NF	Fair
FAR	Poor
NF	Fair
FAR	Poor
NF	Poor

ACCURACY

Next I compared the Rapid Condition Assessment data to the intensive vegetation data collected by Marc Jones. I was not able to compare with the bird data because it was not completed yet. Marc calculated a Vegetation Index of Biological Integrity, which represents all the disturbance measures (e.g. pugging and hummock densities, hummock depth, bare ground, bankfull height, frequency of unstable banks and frequency of plots with heavy browsing) combined.

I first compared the Vegetation Index of Biological Integrity (a multi-metric index) to DEQ's Rapid Condition Assessment final scores. I calculated the correlation coefficient between the two sets of data, which came out to 0.627 (see Figure 6).

FIGURE 6: DEQ AND VIBI CORRELATION

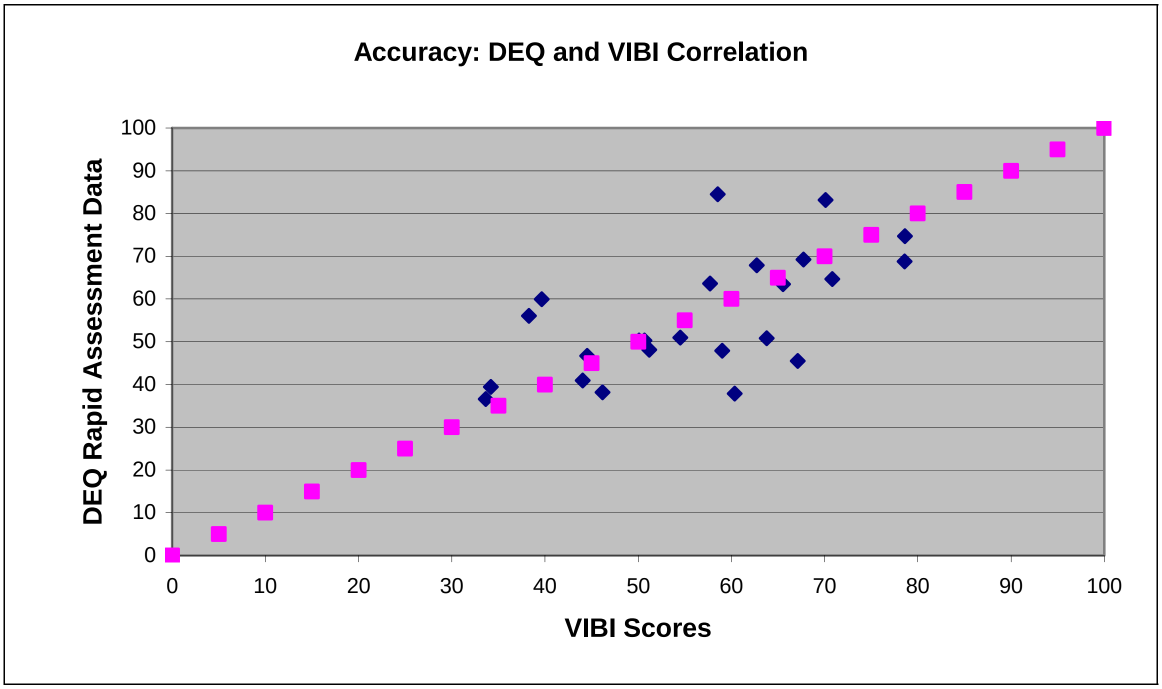

Figure 6: DEQ and VIBI Correlation. The pink line represents a perfect correlation, and the blue points are the actual data.

I also analyzed the data Marc collected in individual disturbance measures. Some of the measures were not included in the Rapid Condition Assessment form, such as hummock depth, bankfull height and frequency of unstable banks, so I didn't analyze these measures. I compared Marc's pugging/hummock, bare ground and browse questions with similar questions in DEQ's form to see if the eliminated measures were lowering the correlation.

Since the DEQ form combines pugging and hummocks into one question, I took the average of Marc's pugging and hummock density questions. The correlation coefficient for pugging/hummocks is 0.50 (see Figure 7). The correlation coefficient for bare ground is 0.31 (see Figure 8). For browsing, I combined the DEQ browse utilization and shrub architecture question scores. The correlation coefficient for browsing is 0.49 (see Figure 9).

FIGURE 7: PUGGING/HUMMOCK CORRELATION

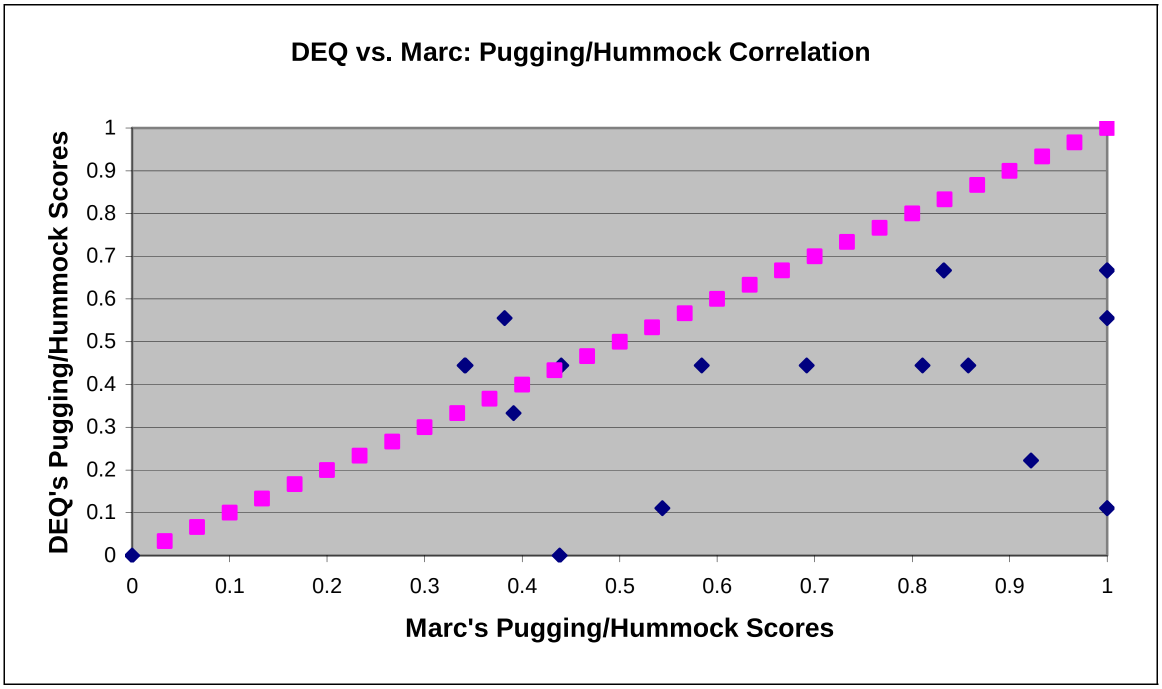

Figure 7: Pugging/Hummock Correlation. The pink line represents a perfect correlation and the blue points are the actual data.

FIGURE 8: BARE GROUND CORRELATION

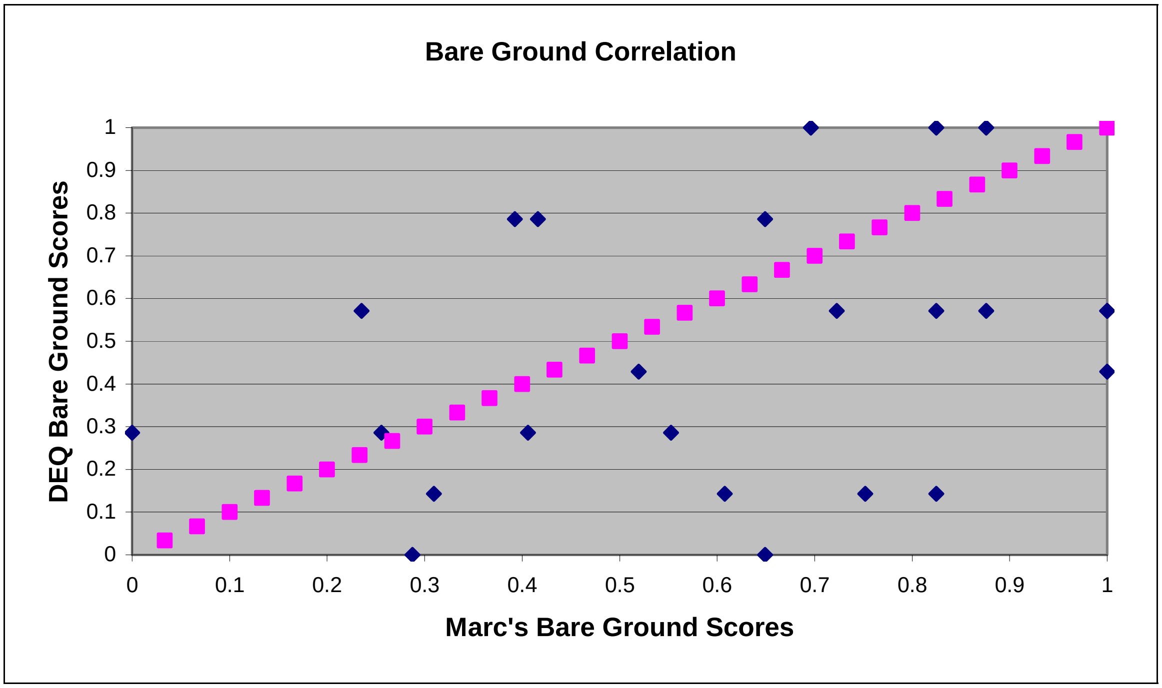

Figure 8: Bare Ground Correlation. The pink line represents a perfect correlation and the blue points are the actual data.

FIGURE 9: BROWSING CORRELATION

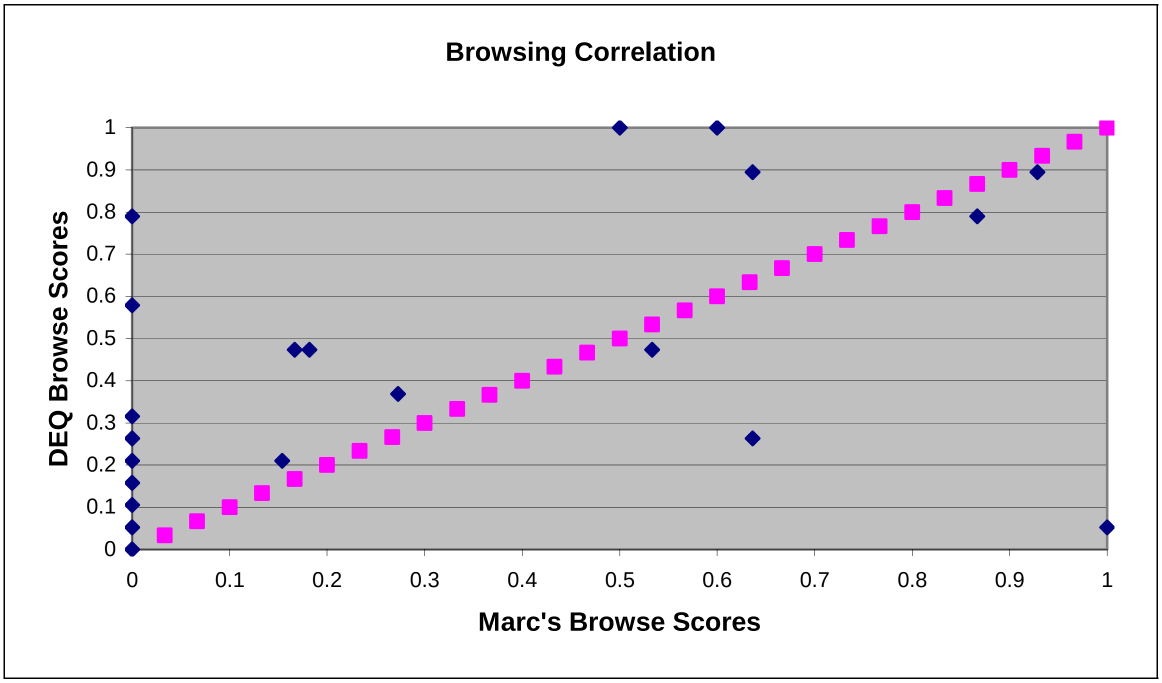

Figure 9: Browsing Correlation. The pink line represents a perfect correlation and the blue points are the actual data.

DISCUSSION

The overall relative percent difference for Erin and my precision on the DEQ form was only 7%. Relative to the goal of less than or equal to 20%, this is a reasonable number. Considering this was our first summer using the DEQ form, and we had only had about a week's worth of training, our precision was excellent.

The precision for the individual questions indicated which questions were the least precise, and the results make sense in relation to our experience filling out the form. The least precise question was #5, in the Hydrogeomorphology section, which asks for the percent of back or side riverine channels blocked by filling or irrigation headgates (see Appendix D to refer to question). On the form, the question states, "do not answer if no back or side channels are present."

Apparently, Erin and I had different opinions regarding this question, because she answered it several times, circling "< 1%," when I usually left it blank. She simply thought side channels were present when I did not. This skewed the Hydrogeomorphology score quite a bit, because circling "< 1%" gives 10 points, while leaving it blank gives 0 points. This problem could easily be fixed by providing a clear explanation of what side channels are, which would clear up the confusion.

The next least precise question was #25, in the Vegetation section, which asks for the percent of each shrub that is being browsed (see Appendix D to refer to question). This question requires an estimation of percentage, which can obviously vary quite a bit between the assessors.

The next least precise question was #22, in the Vegetation section, which asks for the percent removal of tree layer (see Appendix D to refer to question). If no trees are present, the question is supposed to be skipped. Erin and I disagreed about what constituted a community of trees; sometimes there were only 1 or 2 trees present, and she might give it a 10 and I might skip the question. While this doesn't affect the overall score of the site, it skews the results when analyzing the individual question precision, because a blank question counts as zero (which is very different from a 10).

The next least precise question was #20, in the Buffer Condition section, which asks for the distance of roads from the wetland. Again, this question isn't filled out if no roads are present within the 100 meter buffer. The same problem occurs in data analysis: you have a maximum score of 8 (if a 2-track road is within 50-100 meters) and a minimum of zero, making the question imprecise.

The next imprecise question was #27, in the Vegetation section, which asks for the percent of mature shrubs that are dying or unhealthy. The wording of this question turned out to be a source of confusion, because we weren't sure if it pertained to the percent of the *individual* shrub or the percent of *all* the shrubs. There was also some confusion over what is considered "dying or unhealthy."

Shrub architecture is very complex because a shrub can appear to be heavily browsed, but in reality be healthy. It depends on whether the annual or second-year growth segments are being browsed. Annual segments being eaten is normal and still allows for the shrub to grow back, whereas browsing that reaches the second-year segments is more difficult to recover from.

The comparison between the DEQ and MDT scores produced results similar to what I expected. I expected the MDT scores to be quite different from the DEQ scores due to the differences in the two forms. Indeed, only 31% of the sites met our goal of less than or equal to 20% relative percent difference.

These results lead me to believe that the MDT and DEQ forms assess different indicators and therefore serve different functions. The MDT form primarily assesses wetland functions and values, while only addressing wetland condition in one question (which only allows for three descriptions of disturbance: low, moderate and high). The DEQ form focuses on wetland condition, so it is no surprise that the final condition scores of the 2004 wetland sites differ widely from the MDT scores. It is possible the MDT and DEQ forms could be combined; the MDT form serving as a mitigation module and the DEQ form serving as a condition module.

The comparison between the DEQ and NRCS scores also produced predicted results. I expected the NRCS scores to be more similar than MDT's, because the NRCS form is more comparable to the DEQ form. Indeed, 60% of the NRCS scores met the goal of less than or equal to 20% relative percent difference, which is almost double the percentage of MDT scores that met the goal.

The NRCS form is more condition-oriented than the MDT form; it devotes 8 out of 10 questions to wetland condition and only 2 out of 10 questions to functional considerations. DEQ will likely incorporate some elements of the NRCS form such as wording, scoring and formatting into the Rapid Condition Assessment form once revisions are considered.

The comparison between the DEQ and BLM/USFS assessments showed that the DEQ Rapid Condition Assessment form could produce results that are reasonably comparable to a Federal Government Agency's assessment. I do not know exactly how

BLM assessed the sites or what indicators were assessed, but the most likely reason the results were different from DEQ results is because BLM visited the sites several years prior to 2004. The condition of the sites could have changed quite a bit between BLM's visit and ours.

The results from Bryce's crew were again not surprising. The average standard deviation of 0.75 is much higher than Erin's and my average standard deviation of 0.17, but that is understandable because Erin and I had much more training in using the Rapid Condition Assessment form than Bryce and his crew did. We also had an entire summer to get used to the form, while they only used it for two days. The questions they had the most trouble with are similar to the ones Erin and I had the most trouble with, so we will certainly take that into consideration when we revise the form. Those questions probably need to be changed.

The accuracy test, comparing Marc's data with Erin's and my data, produced a good correlation of 0.627. The correlation between the individual metrics wasn't as high, with the highest correlation in the individual measures being 0.50 for pugging/hummocks. I think the difference between the two sets of data is due to the difference in intensity of assessments; Marc spent more time at each site and used more quantitative disturbance measures than Erin and I did. Marc is also a vegetation specialist with a Master's degree in botany, whereas Erin and I are only undergraduate students. Considering all these factors, the correlation was high enough to conclude that Erin's and my data were reasonably accurate.

The measure with the lowest correlation is bare ground, and one reason this may have occurred is Erin's and my difficulty to distinguish between "<1%" and "1-10%."

These are the first two scoring categories in the bare ground question, with a <1% receiving a score of 10 and a 1-10% receiving a score of 7. As a result, Erin and I ended up marking down the sites more than we needed to. Marc measured the actual percentage, as opposed to categorizing, so looking at his data brought this discrepancy to my attention. When the form is revised, the DEQ bare ground question will probably be changed to qualitative categories instead of percentage estimations.

CONCLUSIONS

The testing of the DEQ form was successful and we collected plenty of useful information. We determined that interns are fully capable of conducting Wetland Rapid Condition Assessments, and with minimal training it is possible to be reasonably precise. Volunteers are also capable of conducting Wetland Rapid Condition Assessments, but training is essential, especially if the volunteers do not have scientific backgrounds. With about a week's training, interns and volunteers alike should be able to accurately conduct Rapid Condition Assessments.

The Wetland Rapid Condition Assessment form proved to be comparable to the NRCS Riparian Assessment form and the BLM Proper Functioning Condition assessment method. These methods are comparable because they have a similar purpose, the assessment of condition. The Wetland Rapid Condition Assessment form was not comparable to the Montana Department of Transportation Wetland Assessment form, because the MDT form is targeted more towards functions and values than condition.

The correlation between Rapid Condition Assessment data and intensive vegetation data was sufficient to conclude that the interns' data was reasonably accurate.

This comparison also helped determine the form’s limitations, such as delineating condition categories. My results suggest that with careful revision and comprehensive training of interns and volunteers, the Wetland Rapid Condition Assessment form will prove to be useful in determining wetland condition in the future.

The next step is to use the data I collected and my conclusions to revise the form. DEQ wants the form to be as user-friendly as possible, while still assessing wetland condition both accurately and scientifically. A revision committee has been created that will review the form and the data to decide how to make revisions. By the summer of 2005, the form will be ready to be tested again, this time incorporating volunteers from Montana Watercourse. The next testing will take place in the Gallatin Valley.

FINAL THOUGHTS

When I was assigned to take the lead in developing Montana’s Wetland Rapid Condition Assessment method, I remember being completely clueless as to what a Rapid Condition Assessment was. I distinctly remember that post-it note on my desk asking me to tackle this ambiguous task, and at that time Randy happened to be on vacation. I couldn’t even ask him what he meant. I went straight to the state library and researched the topic all I could, then called everyone I knew who might have some insight into Rapid Condition Assessment.

It’s amazing how far this project has come in my two years at DEQ, and it has taught me so much. Being self-directed on this project enabled me to learn time management skills, and the sense of accomplishment and leadership that came with the opportunity to lead a project has been extremely rewarding.

Spending a summer in the field with Erin was also a great opportunity and quite an adventure. We had to completely rely on ourselves and each other because there were no people for miles. I have never driven on worse roads or worked longer days! As tiring as the fieldwork was at the time, I can look back on it now as a once-in-a-lifetime adventure that I will always remember fondly.

Working in a bureaucracy has taught me extreme patience and I have sincerely enjoyed meeting people involved in every stage of the bureaucratic process. I never imagined a college internship could provide so many lessons and opportunities. I feel honored to have been a part of this project, and I am excited to see it continuing into the future. My hope is that someday the data collected from Wetland Rapid Condition Assessments can lead to the preservation and recovery of those wetlands.

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APPENDIX A. RESEARCH NOTES

EPA "Review of Rapid Methods for Assessing Wetland Conditions"

- Analysis of existing wetland rapid assessment methods
- First step in developing guidance for EPA and state agencies on how to develop rapid assessment

Criteria:

1) Method can be used to measure condition.
2) The method is truly rapid (no more than 2 people will spend no more than ½ day in the field and ½ day analyzing data). It is easy to use and perform in the field.
3) The method is a site assessment; not based solely on surrounding conditions or potential to perform certain wetland functions.
4) Method can be verified

*Only 15 methods consulted; only 4 selected:

a) Draft Delaware Method
b) Massachusetts Coastal Zone Mgmt. Method
c) Ohio's Rapid Assessment Method
d) Washington State's Wetlands Rating System

Rapid Assessment Methods are sensitive tools to assess anthropogenic impacts to wetland ecosystems.

1) Draft Delaware Method

Pros:

a) Assesses condition
b) Easy to use
c) Can be done in less than ½ a day
d) Can be used on all HGM subclasses
e) Stressors that detract from factors lower score

Cons:

f) May not work for sites with non-point source impacts. Assumes site is in good condition unless there is evidence to the contrary. If non-point source, it's hard to determine contamination/impacts with Rapid Assessment.

Based on 4 "Functions:"

1) Hydrology
2) Habitat/Plant Community
3) Biogeochemical Cycling
4) Landscape Setting (aerial photos)

2) <u>Massachusetts Coastal Zone Management Method</u>

Pros:

a) Rapid
b) Evaluates condition
c) Evaluates tidal and non-tidal systems
d) Easy to follow
e) Flexible scoring

Cons:

f) Developed specifically for macroinvertebrate habitat
g) Combines numerous stressors into one indicator

3) <u>Ohio's Rapid Assessment Method</u>

- Based on 6 metrics
- Each metric scored by evaluating several indicators

Pros:

a) Rapid
b) Questions clearly stated
c) Provides an overall rating
d) Easy to calculate final score

Cons:

e) Includes some "value-added" metrics such as presence of rare species which may score wetland higher, but isn't necessarily an indicator of condition

4) <u>Washington State's Wetlands Rating System</u>

- Based on a series of questions
- Combo of yes/no and categorical answers
- Place site into 4 regulatory categories

Pros:

a) Rapid
b) Easy
c) Includes measures of condition

Cons:

d) Only category II and III receive an actual numerical score
e) Wetlands can score higher based on a variable that is not related to condition
f) No separation between tidal and non-tidal

APPENDIX B. OUTLINE

Topics for questions that will determine "score" of wetland:

I. Hydrology
   a. Hydrological alterations
      1. Damming
      2. Dewatering
      3. Filling/dredging
      4. Diversion of water
   b. Presence of water
      1. Water level elevated or depeleted
   c. Geomorphology
      1. Bank erosion
      2. Downcutting
      3. Lateral erosion
      4. Width/depth ratio
      5. Sedimentation

II. Land Use
   a. Surrounding land use
      1. Agriculture
      2. Mining
      3. Roads/railroads
      4. Residential development
   b. Intensity of surrounding land use
      1. Immediate land use (small scale)
      2. Distant land use (large scale)
   c. Buffer zone

III. Habitat
   a. Bird habitat indicators (vegetation structure)
   b. Amphibian/reptile habitat indicators
   c. Mammal habitat indicators
   d. Fish habitat indicators

IV. Vegetation
   a. Density and vigor of vegetation
   b. Presence of noxious weeds or abundance of undesirable species (indicator species)
   c. Browsing
   d. Dead or dying shrubs or trees
   e. Trampling

V. Soils
   a. Percent bare soil
   b. Rutted by trails or roads
   c. Pugging or hummocks
   d. Depth of O or A horizon

APPENDIX C: ROUGH DRAFT

APPENDIX D: FINAL DRAFT

APPENDIX E: MDT WETLAND ASSESSMENT FORM

APPENDIX F: NRCS RIPARIAN ASSESSMENT FORM

APPENDIX G: ARCVIEW GIS TOPOGRAPHIC MAP

Grimes Creek and Big Hollow Creek

APPENDIX H: BLM AERIAL PHOTO
Grimes Creek

APPENDIX I: FIELD EQUIPMENT CHECKLIST

Wetland Rapid Assessment: Field Equipment Checklist

- ❑ Digital camera
- ❑ GPS
- ❑ Extra batteries
- ❑ Orange tape
- ❑ File Box
- ❑ Photo key
- ❑ Clipboards
- ❑ Noxious Weed Books
- ❑ Plant Book
- ❑ First aid kit
- ❑ Fieldbook
- ❑ Measuring Stick
- ❑ Pens/pencils
- ❑ Sunscreen
- ❑ Toilet Paper
- ❑ Stove/propane
- ❑ Camp Saw
- ❑ Water jug
- ❑ Horiba
- ❑ Waders/boots
- ❑ Backpack

APPENDIX J: BRYCE AND CREW'S COMMENTS

Wetland Type

- Some variability may be due to experience of the surveyor with the site on previous years during drier periods of the year.
- Temporary versus seasonal versus semi-permanent is very difficult to assess on a single visit.

Water Quality Condition Assessment

- Misunderstandings resulted from the turbidity question because many people read the question as having to do with toxic sediments instead of two separate issues (toxics versus sediments). This is the case with a few items on the form that effectively have two issues listed under the same question. Why not split all of these out so that it is unambiguous to the surveyor and so that the data is parsed out into smaller pieces for easy analysis.
- Cattle feces should be listed as one of the nutrient inputs.

Hydrogeomorphology Condition Assessment

- Seriousness of down cutting through old beaver dam sediments versus normal ground? Clearly old beaver dam sediments will be softer and more easily eroded.

Buffer Condition Assessment

- Everyone still wondered why grazing was not included in the buffer condition assessment since that is one of the, if not the, main impact on the buffer in many areas.

Vegetation Condition Assessment

- After the issue of not being able to identify species given the current photos and other ID materials, the biggest issue is what is to be considered? High water mark, low water mark, stark vegetation contrast between terrestrial and aquatic. If we consider stark contrast only, shouldn't we be assessing vegetation condition in the buffer because of its importance?
- We need to evaluate aquatic vegetation (exotics versus natives).
- Instructions say dead wood, but form says dead wood or unhealthy for shrub health. This resulted in confusion and differences in scoring (i.e. dead wood versus unhealthy). Maybe there could be separate subsections and scores for dead versus unhealthy.
- The term cover can be confusing because if a species is well distributed around the wetland, but there are only a few plants present, then someone might consider it to have a very high coverage. I assume you are after actual percentage of total area covered?
- Simpler photos for the guide would be better than the complex schematics present in the current version of the guide book for shrub architecture, browse utilization and shrub regeneration.

Restorability

1. If we don't know what the grazing regime (timing and intensity) is, then it seems hard to evaluate this in the field.
2. Differences between answers may be due to the fact that there are several statements in the category ranks and one person might be responding to one statement while another person might be respond to another statement.
3. Some people evaluated site 003 for restorability as if the dam is and was there and how do we restore veg around the margins of the lake. Others, like myself, said the dam totally drowned the entire historic wetland and was therefore scored much lower.

Miscellaneous

1. A little bit of general confusion throughout due to lack of experience with terminology and wetland evaluation. Overall this brings up the need for a lengthy training session with a number of sites followed by discussion and then run everyone through a standardization exercise like this before sending them out for the rest of the summer. Also, they should spend a couple of days surveying sites with an experienced surveyor. Most of the differences came from differences in interpretation that could easily be standardized by going through different wetlands together.
2. Shouldn't invasive species be in the list of overwhelming stressors. Natural disturbances may be occurring and having invasive species in the area would be the stressor in this case because, for example, if a natural fire moved through an area the invasive species would only become established if they were present in the area.
3. The overall form could be greatly reduced in length in order to save paper and bulk. For example, there are a number of blank areas on the pages and people felt like it was a waste of time to calculate the percentages in the field so they weren't really needed at all. Similarly anything else that can't be answered in the field, like 12 digit huc code, could be eliminated in order to reduce the lengths of the field forms.
4. Need something on angle of slopes surrounding wetland because wetlands with slopes around them will be much more impacted from a given level of ungulate grazing/trampling pressure than a wetland with flatter ground around it.
5. On question about the wetland having >20cm of organic material many people answered "No" on the beaver site (109) because even though it was holding more than 20cm of sediments it wasn't bouncy. Do we go off of >20cm or do we go off of bouncy?
6. On site 109 some people answered with a 1 on the headgate question because of the headgate on site 003 which is above the site. I think they did a great job on this, but I didn't consider it because it was so distant from the site. However, this brings up a good point because of the limitations of surveying 1 or only a few sites in a watershed instead of evaluating an entire watershed as a unit.
7. There seemed to be quite a bit of variability with answers on the "trending" questions. The crews all felt this was a hard thing to answer on a single visit. For example, if you went to a site in the spring before cattle were turned out you

might say it was trending upward, but if it was surveyed a few weeks later after the cattle had been turned out you might say it was trending downward. Similarly, our documentation of what is causing the impact or trend might change – elk in the spring versus cattle in the summer at sites 002 and 003.

8. Put all number scores in separate boxes would reduce confusion resulting from having them included with the text.
9. Again, I would encourage use of a single datum (NAD27) because that is what is on the topographic maps and would also encourage the use of UTM coordinates because they are easy to interpret in the field and are on the topo maps.
10. Need to have an example datasheet filled out so that people can refer to it in order to see the types of comments you are after.
11. Many people felt like the final comments category was redundant because they had already listed their comments in all of the other sections.

APPENDIX K: DIFFICULTIES AND COMMENTS

DEQ Form:

- Erin Farris suggested numbering the questions on the form to make it easier to follow
- "Recovery Trends" section in Hydrogeomorphology should probably be eliminated; it is very hard to assess, especially at beaver ponds and depressionals.
- Some difficulties with shrub questions – could see how these would be hard to grasp for inexperienced volunteers.
- Shrub Architecture question is confusing and ineffective. If there is any browsing at all, then all the shrubs will have retrogressed architecture, giving it the lowest score even if browsing is minimal. This question needs to be re-worded or eliminated.
- Need to add "Beaver Pond" to Wetland Type Picklist on front page, that is, if we decide to use beaver ponds in the future.
- Need to re-word the organic material question on first page. Could just ask if the wetland contains organic soil. Saying 20cm implies the need to measure soil depth, which we don't want to do.
- For site map, should create a "legend" showing what symbol to draw for different types of vegetation. This would make site maps easier to compare.
- Should separate sediment and toxics questions.
- Don't need as many Comments sections; could just put one at the beginning or end.
- "Rank top 3 stressors" questions in each section seem a bit repetitive. It's not very often that they change. Maybe don't need them.
- Need to clarify when to fill out Trees section. Maybe only fill out if a "community" of trees is present… define "community" as in more than 3 trees, or something like that.

MDT Form:

- The organization of the wetland type classification (#10) is confusing. The abbreviations should be ordered in more of a list format… that would be easier to read and understand.
- The wording in question 14Cii is unclear. It says "<10% of AA"… why <10%? What does that refer to?
- The wording in question 14H is confusing. "Duration of surface water adjacent to rooted vegetation" … what does "adjacent" refer to? It could be interpreted several ways.
- In question 12i, "grazing" is considered disturbance. Is this just livestock grazing, or does it include wildlife grazing? We encountered many sites that were heavily grazed by moose or elk, and weren't sure if it counted as disturbance.

NRCS Form:

- The lines in the "comments" sections are very small, making it difficult to write.
- Question #1: to score a "4," the stream is supposed to have a "small headcut, in early stage." There were numerous streams that we felt should be scored a 4, simply because it is the middle score, but they didn't have a headcut.
- Question #2: our small wetland streams never have enough energy to cut laterally.
- Question #3: only mentions de-watering as a cause of widening, but grazing (livestock trampling) is causing our streams to widen at nearly every site we visit. Also the categories in this question do not include streams that have widened in the past, but are recovering and getting narrower.
- Question #5: the title uses the phrase "vegetative cover" but the categories use "canopy cover." This is confusing. The percentages in this category seem very high. The primary species we encounter having a deep binding rootmass is willow, and most sites do not have >75% cover. It seems too harsh to give every site a "0."
- Question #8: in the "4" category, the wording is confusing. It says "two age classes (seedlings and saplings)." Does this imply that seedlings and saplings are 2 separate age classes? Then it says "other age classes well represented." This is also confusing because it sounds as if there is more than one age class left, but it said in the previous sentence "the stand is comprised of mainly mature species." These sentences seem to contradict each other.
- Question #10: We had a lot of trouble assessing this question. Our streams are small, sometimes with very little water, so dissipating energy doesn't seem to be an issue. Furthermore, most of our streams do not have large boulders and woody debris. It just doesn't seem to apply to smaller streams.
- Summary Page: only about half the space on this page is used up, and the font is very small. It would help to enlarge the font and the spaces where you have to fill in the scores. There is also no space to write the final % rating. The potential scores for "most bedrock or boulder streams" and "most low energy E streams" is confusing. Our streams are low energy E streams… are we supposed to skip questions 8 and 9? Those questions are important to assess for us, and the ones that should be skipped are 2 and 10. These directions should be explained at the beginning of the form instead of the end.